FERMILAB CONTROLLED ACCESS HANDOUT

Note: The hyperlinks below will take you to streaming video segments of the Controlled Access video. If you would prefer to view portions of the video with a stand-alone player rather than your web browser, click here.

1. Purpose and Definitions

A controlled access is a means by which two or more people may safely enter an interlocked enclosure. A controlled access is used instead of a supervised access when it is desired to quickly resume operation after an access. Because a controlled access does not involve dropping the interlocks and subsequently searching and resecuring the enclosure, it minimizes disruption to accelerator operations.

Personnel entering enclosures under controlled access conditions are subject to increased hazards due to a reduction in the level of sophistication of several safety measures. Because of this, personnel making controlled accesses must have additional training in order to know what safeguards have been reduced and to understand the procedures necessary to ensure their safety.

The conditions for supervised access and controlled access differ as follows:

Supervised Access: A radiation survey has been completed and documented since particle beams were accelerated or transported through the beam enclosure and the results have been included in the Radiation Work Permit (RWP). The radiation and electrical safety system interlocks have been dropped to prevent energizing of exposed electrical bus and to prevent particle beam transport. Power supplies for beamline components that have exposed electrical connections have been locked off (" configuration control").

Controlled Access: The radiation and electrical safety system enclosure interlocks are active and monitoring the status of the enclosure. The controlled access key, when issued to persons making an access, prevents electrical power to exposed bus and prevents beam from entering the enclosure. A documented radiation survey has not been performed, so no survey data are included in the RWP and individuals making the controlled access are responsible for performing their own radiation survey.

The change from controlled access to supervised access in made under the exclusive control of the Operations Department through the Crew Chief in the Main Control Room (MCR). No other individual is authorized to make this change.

Three conditions must be met before the Operations Department may change a beam enclosure status from controlled access to supervised access:

- In those enclosures requiring a radiation survey, the survey under supervision of the Beams Division's Environment, Safety, and Health (ES&H) Department (or, in the case of DØ and the Collider Detector at Fermilab (CDF), Particle Physics Division's (PPD) ES&H/Building Management Services) must have been performed. In those enclosures requiring a supervised access RWP, the RWP must have been revised since the last time the proton beam was in the area or determined to still reflect current conditions.
- The safety system must be " broken" (interlocks are dropped), requiring a search and secure before beam can be reenabled.
- The operators must perform configuration control for the enclosure by locking off power supplies for beamline components that have exposed electrical connections. This is done based on the configuration control list provided by the BD ES&H Department and kept in the MCR.

If the safety system is inadvertently broken during a controlled access, the

Crew Chief must choose between one of the following options:

Option 1 - The Crew Chief in consultation with the Operations Department Head and the Beams Division Radiation Safety Officer (RSO) or his/her designee may elect to make the transition to supervised access. In this case, the operators perform configuration control and the ES&H Department performs a radiation survey of the enclosure and updates the RWP, if appropriate.

Option 2 - The Crew Chief may elect to resecure the enclosure. The enclosure shall be secured by the end of the shift unless the on-coming shift assumes responsibility, in which case, search and secure must commence within two hours of the shift start.

2. Qualification for Controlled Accesses

To ensure that controlled accesses can be conducted safely and reliably, the following procedures have been implemented:

A. Before issuing enclosure keys, either directly or via remote key tree, MCR personnel will verify using the key logger or TRAIN database that the entrants have the required training. The qualification requirements are:

a. Personnel not previously controlled access qualified must attend a formal training session. Trainees must have completed Radiolog-ical Worker and, if applicable, LOTO Level 2, training prior to receiving controlled access training. Personnel previously trained in controlled access must requalify annually by either attending the classroom session again or taking the " challenge exam" version of the course. Both versions of the course require the trainee to pass an examination covering essential course information.

b. Each trainee receives this controlled access handout either at or prior to the class or challenge exam. Upon receipt, the trainee should have his/her supervisor complete the Supervisor Certifications box on the accompanying form. After the individual has read and clearly understood all the information contained in the handout, he/she should sign the form and return it to the instructor at the conclusion of the class/exam or as soon as possible thereafter. The training is not considered complete until the form is submitted. The instructor will ensure that all of the required training elements have been met, sign the form, and enter the qualification into the database.

c. Trained personnel will be allowed to make controlled accesses throughout the Beams Division and PPD areas. Additional requirements may be imposed in special areas (e.g., training and medical qualification for oxygen deficiency hazard (ODH) areas). Note that there may be additional training requirements for entering PPD enclosures and the collision halls when in the collider mode of operation.

B. Visitors or personnel who are not controlled access qualified may be permitted to make a controlled access if deemed necessary by the management of the organization having jurisdiction over the affected enclosure and approved by the appropriate Senior Safety Officer or his/her designee. In this case, the unqualified individual must receive a safety briefing from an RSO or his/her designee. Unqualified personnel must be escorted during the entire access. Although the untrained person must have his/her own enclosure key, he/she does not operate the interlock enter boxes. Only the qualified escorts may do this. Therefore, although there must be one qualified escort for each unqualified person, a minimum of two qualified people is required to make the access. An untrained person must be escorted for the entire time he/she has possession of the enclosure key. Escorts are responsible for ensuring that unqualified entrants observe all safety requirements.

3. Potential Hazards

There are potential hazards associated with controlled accesses. However, following the correct procedures can minimize these hazards.

A. Direct Beam-On Radiation. When a key is removed from the key tree to allow access, the beam is inhibited in a fail-safe manner by several devices. If you are in an interlocked enclosure without a controlled access key for that area, then the beam could be turned on. If a person is in a beam enclosure during beam-on conditions, he or she is in immediate danger of receiving a large acute radiation exposure. If beam is lost by scraping a beam pipe or striking a magnet, the radiation levels could cause an acute exposure in excess of 450 rads. An acute exposure of 450 rads will cause death within 30 days to 50% of those so exposed.

B. Electrocution. Prior to controlled accesses into the accelerator and external beamline enclosures, the electrical safety system permit is removed, which disables power to exposed conductors with hazardous voltages and/or currents. The power supplies connected to components with exposed electrical connections are normally shut off by the electrical safety system when the controlled access keys are removed from the key tree. Components with no exposed electrical connections normally remain energized.

Although the electrical safety system is intended to protect entrants from exposed electrical hazards, it depends upon numerous electrical and mechanical components that are not immune to failure. Reliance on the safety system alone is unsafe and does not satisfy LOTO requirements. Therefore, you must make certain that power has been locked off to any component you work on or may come in contact with. If you are in an enclosure and have not locked out components you are working on, you could be electrocuted! The individual doing the work is responsible for ensuring that the component is locked with his or her lock and danger-tagged in accordance with LOTO procedures. You must supply your own locks for this purpose. These locks are available from the stockroom. Prior to performing LOTO, the individual must have completed LOTO Level 2 training. (Note that LOTO is also required for working on beamline components under supervised access conditions. The configuration control performed by the Operations Department does not satisfy LOTO requirements because those locks are not applied by the people exposed to the hazard. They are merely an extra layer of safety.)

C. Residual Radioactivity. After the proton beam strikes an object, the object becomes radioactive. During a controlled access, the enclosure has not been surveyed and tagged for radioactivity before you enter. During a controlled access, you are the person who has to do the radiation survey in the area where you are working. Past experience as to the residual radioactivity level must not be relied upon. Experience has shown that it only takes a beam loss for a short period of time for high levels of residual radioactivity to be present shortly after the beam is turned off. Local radiation level postings are not to be used, as they might not be accurate; only the survey meter can be relied upon. It is also important to remember that contamination surveys have not been performed, and one must follow all hold points specified on the RWP. The appropriate protective clothing must be worn when working on beamline elements, when the beam pipe is going to be opened up, or any disassembly work is required.

Individuals making accesses to beam enclosures (during both controlled and supervised accesses) and other posted radiation areas must wear dosimetry specified by the RWP. In order to ensure that the 100-mrem-per-week local control limit is not exceeded, individuals who make controlled accesses to enclosures and other posted radiation areas must keep pocket dosimeter records for the accesses. The records should be submitted to the individual's local ES&H department or group for tracking. Prior RSO approval must be obtained before the weekly exposure limit of 100 mrem may be exceeded.

D. Internalized Radioactivity. Small quantities of radioactive material (in the form of dust, metal grindings, etc.) are hazardous if ingested,

inhaled, or injected into the body. This is because the material, a source of radiation, may stay in the body for a long period of time, giving a large dose to a localized area of the body. Therefore, you are not permitted to smoke, eat, or drink in any beam enclosures. If you get some radioactive material on your hands, these actions could cause it to be internalized. All posted signs and instructions regarding contaminated areas and protective clothing requirements are to be obeyed. The controlled access RWP will specify the protective clothing requirements for the type of work to be performed.

E. Oxygen Deficiency Hazard. Certain areas of the accelerator and extraction beamlines are classified as ODH areas due to the large quantities of inert gases contained in the cryogenic systems. If these gases were to leak, they could reduce oxygen levels to less than life-supporting. ODH procedures are to be followed in these areas at all times.

4. Warning Devices

If you find yourself in an enclosure and hear a loud whooping sound or verbal warning message, take immediate action.

The warning sound can be generated as a result of several scenarios:

- An electrical permit is about to be issued.
- Oxygen levels have dropped below 19.5 percent.
- Interlocks are being tested.
- A search and secure of an adjacent enclosure is taking place.

You must always treat these audible warnings as real and follow the instructions presented in this training.

If you hear a warning sound or message, pull the crash cord or push the crash button, if they are available in your area. Then hurry to the nearest exit and open the door or gate without using the access procedure. This will drop the interlocks for that area, preventing beam from being transported to the enclosure. Then exit the enclosure.

If there are no crash cords or buttons in the area you are in, go immediately to the nearest exit and open the door or gate without using the controlled access procedure.

Do not stop at a telephone in the enclosure to call and report the warning. Leave the enclosure immediately and call the MCR from a telephone outside the enclosure to report what happened.

5. Controlled Access Rules

Deviations from these rules are allowed only with permission of the RSO or designee. Employees who violate the rules are subject to disciplinary action. The exact punishment for the offense would be determined by management based upon severity of the incident and details of the circumstances. Experimenters who violate the rules may lose their authorization to make controlled accesses. Additional restrictions on the use of laboratory facilities may be made at the discretion of Laboratory management.

A. You must read and sign the RWP for the enclosure to be accessed, if an RWP exists. Experimental halls generally do not have RWPs.

B. You must obtain a controlled access key for the area entered and maintain control of the key until returned. Keys for most Beams Division enclosures are located at the Main Control Room. Other keys are located at remote key trees near the enclosure entrances.

C. You must lock out with your own padlock and danger-tag any device that you work on that has voltages that could exceed 50 volts or 1 joule of stored energy to exposed conductors (or the work you are doing will cause the conductors to become exposed). For accesses into the Tevatron, Main Injector, or Mini-BooNE (MI-12A or B) enclosures that involve any work on or near the bus or beamline elements with exposed connectors, you must also apply a lock(s) to the appropriate group lock box(es) in the MCR. Locking out the 13.8-KV power in this way even when conducting inspection-only type activities is also strongly encouraged.

D. You must know how to use a log survey meter (LSM) and you must use one to check radiation levels in the area where you are working.

E. You must wear protective clothing specified in the RWP for the enclosure to be entered and the type of work to be performed.

For large jobs extending over long periods of time (such as a magnet change), the task leader may request a job-specific RWP. In these cases, the radiation safety group may survey the work area in question and write an RWP solely for the job. Clothing requirements and other RWP requirements may be relaxed for the job. Requirements for work in the remainder of the enclosure would be dictated by the normal controlled access RWP.

F. A controlled access is a hazardous work activity that requires application of the two-person rule. You may not enter a beam enclosure alone. At least two people are required to enter the enclosure for a proper controlled access, even if the entry will be brief and only in the immediate area beyond the gate.

G. You must have the key physically on your person while in an interlocked enclosure.

H. You must never permit entry to another person who does not have a key for the area entered, even if you have one. Thus, you are responsible for checking everyone who makes the controlled access with you. Each person entering an interlocked enclosure must physically display his/her key to other personnel participating in the access upon entry into the enclosure.

I. You are prohibited from giving the key to another individual even if you know he/she is qualified to make controlled accesses.

J. You must inform the Crew Chief if you are going to work in any radiation area where the exposure rate exceeds 100 mR/hr at one foot prior to beginning work. You must receive permission from the RSO or designee prior to beginning work.

K. If exposure rates have increased drastically (compared to levels previously posted) and are greater than 500 mR/hr at one foot, you shall immediately leave the area, check closely for contamination, and inform the Crew Chief. The Crew Chief shall call the RSO or designee to determine subsequent action.

L. You must follow the ODH access procedures if they are required for the area.

M. During a controlled access to repair a problem, it is important to make the repair and complete the access as rapidly as possible. During maintenance and development (M&D) periods, the accelerator may be off for several days. This typically affords more time in which to make controlled accesses. However, because the number of keys available is limited, and because several work groups may need to access the same enclosure, accesses should always be done as expeditiously as possible.

In experimental halls, controlled accesses during accelerator operation have typically been limited to a duration of one hour. This is because of operational considerations and the possibility of prompt rates. On M&D days, Operations and the RSO will review the time limit for controlled

accesses. With the concurrence of both, the time limit may be waived.

N. You must personally return the key to the MCR or remote key tree as soon as the controlled access has been completed. Keys used to make controlled accesses should never be taken home overnight or removed from the site without explicit permission from Operations and the RSO. If you placed a LOTO lock on a group lock box in the MCR, remove it at this time.

6. Generic Access Procedure

A. Pre-planning: Before initiating a controlled access, you should carefully plan your activity. Determine where you will be working, what entrance to use in order to reach that location, and what enclosure key(s) you will need to obtain. Review the hazards associated with your job and complete a written Hazard Analysis if required by Lab policy for the type of work that you are going to perform. Determine any specific LOTO requirements and lock out any power supplies for beamline components on which you intend to work. Your supervisor should be involved in all phases of this planning process.

B. Main Control Room: Read and sign the appropriate RWP(s) for the enclosure(s) you plan to access, if applicable. Obtain the correct key(s) for that enclosure(s). Obtain an LSM and perform the required functional tests. If required for the enclosure(s) you plan to access, sign out and check a personal oxygen monitor and obtain and inspect an escape pack. Obtain the radiation dosimetry specified in the RWP. If you will be performing any work on or near the bus or on any loads attached to the bus in the Tevatron, Main Injector, or Mini-BooNE (MI-12A or B) enclosures, you must attach LOTO locks and tags to the appropriate group lock box or boxes. Placing locks on the group lock boxes when conducting inspection-only type activities is also strongly encouraged.

C. Tunnel entrance: Don the protective clothing specified in the RWP for the type of activity you are going to perform. Check the status of the interlocks on the panel next to the gate. If the interlocks are down, call the MCR. Before anyone inserts and turns a key in the interlock enter box the members of the party must physically display their keys to each other. To begin the access, one entrant inserts his or her key into the exterior interlock enter box and turns and holds the key. Other members of the access party may now unlock the gate or door to the enclosure and pass through it. One of the other entrants then inserts a key in the interior interlock enter box and turns it. The person holding his or her key in the exterior enter box may now remove the key, enter the enclosure and close the gate or door. The person holding the key in the interior enter box can then remove it. Check the interlock system status panel again to verify that the access was successfully carried out without dropping the interlocks. If you encounter problems, call the MCR. It should be noted that the interlocks in fixed target enclosures and fixed target experimental halls are on timers and will drop if the gates are left open for greater than approximately 40 seconds, so move quickly through the gates in these areas. Proceed with your work, remembering to survey your surroundings with the LSM.

D. End of access: Exit enclosure by reversing the procedure in C above. Return key(s) and other items to the MCR.

7. Tevatron Access

A. Although the Tevatron enclosure is a single continuous tunnel, it contains three separately interlocked zones. The area from E34 to F47 is called "F-Sector" and requires a red key. The area from F47 to A24 is called "Transfer Hall" and requires a blue key. The remainder of the ring (A24 to E34) is called "Tevatron A-E Sectors" and requires a white key. Gates equipped with interlock boxes separate these zones.

B. This configuration means that, if you intend to access more than one interlocked region, you need more than one key. You also need to read and sign more than one RWP, and you may need to place a lock on two or more of

the group lock boxes in the Main Control Room.

C. The gates at A24, E34, and F47 are only cored on one side, allowing use without a key in the other direction. This permits access to the exit stairwell beyond the gate in the event of an ODH situation or other emergency. In non-emergency situations, you must remember to do a controlled access through these gates.

D. Because it is so large, the "Tevatron A-E Sectors" zone has been equipped with intrasectorgates in the vicinity of the "zero" service buildings. These gates limit the amount of territory the operators must search and secure if interlocks are dropped in this enclosure. When interlocks on both sides of one of these gates are either "made up" or dropped, the displays above the gate are unlit. In these cases, you can just open the gate and walk through. However, if interlocks on only one side are dropped, the displays will flash "USE KEY TO ENTER." In this case, notify the Main Control Room, then use the controlled access procedure to avoid dropping the interlocks on the side that is still "made up." (Because of its size, the Main Injector enclosure has been subdivided by similar gates.)

8. Boundaries Between Interlock Systems

At certain locations, namely where two enclosures or separate interlock zones meet, two different keys are needed to make a controlled access through the gate, one for the zone you are leaving and one for the zone you are entering. There are two different systems for this currently in use:

A. In the Tevatron and in the fixed target enclosures, the enter boxes each have one key switch. The key for the enclosure on the opposite side of the gate is needed to work each box.

B. At other locations, you must use both keys to operate each interlock enter box. The key-slots are labeled to indicate which key goes where. This type of system can be found at the interface between Switchyard Enclosure B and the Tevatron's "Transfer Hall" zone, where the 8-GeV line meets the Booster and Main Injector, at the boundary between Switchyard enclosure B and enclosures D, E, and F, at the two gates separating the Accumulator-Debuncher enclosure from the Antiproton Transport line, and at the APØ Pre-target/Pre-vault boundary.

9. Access Control at AP-10 via Remote Key Trees

A. When an access is desired, read and sign the local RWP by the key tree. LSMs are also staged in the area of the key tree.

B. Call the MCR (ext. 3723) and report the names and ID numbers of the individuals making the access. MCR personnel must verify the entrants' training before allowing keys to be issued.

C. Stay on the phone with the MCR and, when the key tree door is released, open the key tree and remove the keys needed. Inform MCR personnel of the entrants' name and key numbers so the information can be recorded in the access log. You must always leave one key in the key tree in case emergency access to the enclosure is required.

D. Before access, close the key tree door.

E. After access, call the MCR to have the key tree door released. Place the keys back in the key tree, inform MCR personnel of which keys were returned, then close the key tree door.

10. Access Control at Fixed Target Experimental Halls

A. When an access is desired, call the MCR (ext. 3723) and give the MCR personnel the names and ID numbers of the individuals making the access and the name of the experimental hall they are going to access. MCR personnel must verify the entrants' training before allowing keys to be issued.

B. If the beamline is operating at the time the access is requested, an operator will ensure that beam is removed from the enclosure to be accessed. After the operator has removed beam and unlocked the associated key tree door, the people making the access may each take a key. Inform MCR personnel of the entrants' names and key numbers so that the information can be recorded in the access log.

C. You must always leave one key in the key tree in case emergency access to the enclosure is required.

D. Before access, close the key tree door.

E. Entrants are not required to perform radiation surveys in fixed target experimental halls, which are controlled areas rather than radiation areas. RWPs are not normally required for controlled access into these areas; however, if special circumstances dictated a need for one, review and signature would be prescribed by personnel in the MCR prior to key issuance.

F. All personnel making a controlled access must wear their thermoluminescent dosimeter (TLD) badge. However, pocket dosimeters and protective clothing are usually not required for controlled accesses into fixed target experimental halls.

G. After access, call the MCR to have the key tree door released and report which keys are being returned. Place keys back in the key tree and close the key tree door.

11. Special Provisions for Access Control at CDF and DØ Collision Halls during Collider Operations when Particle Physics Division Controls Access

During collider operations, Particle Physics Division may require additional training and have additional written procedures that are to be followed for controlled access to the collision halls.

NOTE: THIS FORM MUST BE COMPLETED AND SUBMITTED TO THE INSTRUCTOR AT THE CONCLUSION OF THE CLASS OR AS SOON AS POSSIBLE THEREAFTER. THE TRAINING IS NOT COMPLETE UNTIL THE FORM IS SUBMITTED.

TRAINEE:

I understand the hazards involved with controlled access and the procedures required of me.

Name (print) ID # ___

Mail Station Supervisor/Spokesperson __

Telephone # _____ E-Mail _

Signature _____ Date ___

SUPERVISOR CERTIFICATIONS:

I have determined that the above individual has a need to make controlled accesses. I have verified (either directly or through another knowledgeable person) that he/she knows how to use a log survey meter. I have reviewed the activities he/she will perform under controlled access conditions and have determined that Lockout/Tagout Level 2 training is

[ ] required. [ ] not required.

Supervisor Signature _____ Date ___

FOR INSTRUCTOR (RADIATION SAFETY OFFICER DESIGNEE) USE:

Radiation Safety Training Course FN000301/CR Date _____

Controlled Access Training Course FN000311/CR Date _____

Lockout/Tagout Level 2 Training Course FN000212/CR Date ___
(if required above)

The prerequisite training requirements have been met.

RSO or Designee Approval _____ Date ___

Entered into TRAIN Database Date _____ Class Code # _